

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
11 August 2005 (11.08.2005)

PCT

(10) International Publication Number
WO 2005/072194 A2

(51) International Patent Classification: **Not classified**

(21) International Application Number:
PCT/US2005/001617

(22) International Filing Date: 20 January 2005 (20.01.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/537,661 20 January 2004 (20.01.2004) US

(71) Applicants (for all designated States except US): **SUMITOMO HEAVY INDUSTRIES, LTD.** [JP/JP]; Intellectual Property Department, 9-11, Kitashinagawa 5-chome, Shinagawa-ku, Tokyo 141-8686 (JP). **SHI-APD CRYOGENICS, INC.** [US/US]; 1833 Vultee Street, Allentown, PA 18103-4783 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **XU, Mingyao** [CN/US]; 130 Cold Streak Court, Inc., Emmaus, PA 18049 (US). **GAO, Jin Lin** [CN/US]; c/o Shi-Apd Cryogenics,

INC., 1833 Vultee Street, Allentown, PA 18103-4783 (US). **SEITZ, Eric** [US/US]; c/o Shi-Apd Cryogenics, INC., 1833 Vultee Street, Allentown, PA 1803-4783 (US). **SAITO, Motokatsu** [JP/US]; c/o Shi-Apd Cryogenics, INC., 1833 Vultee Street, Allentown, PA 1803-4783 (US).

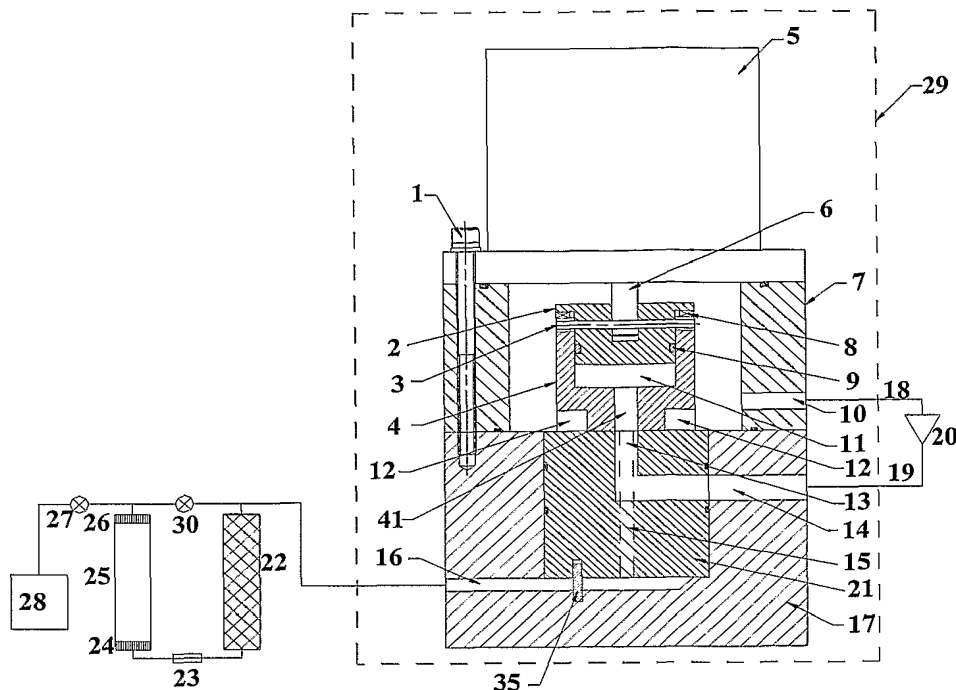
(74) Agents: **HELFGOTT, Samson** et al.; Katten, Muchin, Zavis, Rosenman, 575 Madison Avenue, New York, NY 10022-2585 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH,

[Continued on next page]

(54) Title: REDUCED TORQUE VALVE FOR CRYOGENIC REFRIGERATOR



(57) Abstract: A rotary valve unit which reduces the torque required to turn the valve disc, and the amount of wear dust that is blown into the cold head, using differential gas forces to keep the valve disc in contact with the valve seat, and which enables larger diameter valve discs to be utilized for multi-ported pulse tubes that have less force on the face of the valve disc, resulting in reduced torque and reduced wear rate.

WO 2005/072194 A2



GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.